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WASTEWATER

LOADING GUIDELINES

for the

GRAND RIVER BASIN

Interim Report

WASTEWATER LOADING GUIDELINES

FOR THE

GRAND RIVER BASIN

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INTRODUCTION

The waters of the Grand River drainage system are laden with organic wastes and algal nutrients. The greatest loading pressures, evidenced by excessive growths of algae and aquatic plant life in sections of the Middle and Lower Grand, result from the densely populated urban areas where treated wastewaters are discharged to the river. Although less controllable, land drainage also contributes varying amounts of nutrients throughout the drainage system depending on local land use practices.

Loading rates of carbonaceous oxygen demand consistent with the dissolved oxygen criteria under the present flow regime of the system necessary for the protection of desirable aquatic life for those municipalities with existing or proposed wastewater treatment facilities are estimated. The dissolved oxygen criteria were presented in the 'Guidelines and Criteria for Water Quality Management in Ontario' which were adopted by the OWRC in June 1970. The estimates do not make allowance for variations in dissolved oxygen resulting from daily cycles of photosynthesis superimposed upon respiration, a refinement which will be considered in future analyses as additional data become available.

The maintenance of desirable aquatic life in the Middle and Lower Grand and preservation of the existing high quality of the water in the headwater areas have been used as basic objectives in this analysis. Alternatives considering varying levels of water quality, variations in the available streamflow and corresponding changes in wastewater loadings will be reviewed in the comprehensive basin report to be published later in 1971. Following a public review of these alternatives, the Commission will determine the standards of water quality best suited to the public interests of the overall community in the drainage basin.

BACKGROUND

The Grand River Basin is an example of an intensively developed drainage system in Ontario. Since the turn of this century, the basin has evolved from principally a non-urban agricultural community with supporting small industries into one of the most diversified industrial and agricultural areas in Ontario. During the past two decades, the industrial sector in particular, has enjoyed rapid development accompanied by a high population growth rate. The impressive development of the basin can be attributed mainly to the favourable combination of natural and human resources complemented by an advantageous location close to the rest of the densely developed areas of the province and the availability of essential services.

The disposal of municipal and industrial wastes has resulted in impairment of water quality in some sections of the watershed. Public awareness of these problems and pressure exerted by OWRC and public health agencies led to the construction of required waste treatment facilities for the major municipalities. These facilities reduced significantly the organic waste inputs but continued to discharge nutrients which contribute largely to extensive growths of algae and other aquatic plants. The nutrient enrichment together with the continuing population growth and associated increasing organic wastewater loadings have made it necessary to re-examine the pollution control plan for the Grand River on a basin wide basis.

SUMMARY OF FINDINGS

The quality of water in some sections of the Grand River Basin is impaired by cumulative levels of nutrients and excessive loads of residual organic materials carried in treated waste effluents and land drainage. The greatest nutrient problems generally occur in sections downstream from the densely populated areas. It is estimated that the input of phosphorus, widely considered to be the controlling nutrient in algal production, from the municipal sewage treatment plants accounts for 70 to 80 per cent of the total annual input of this nutrient into the basin.

Comparison of the present wastewater loadings with the estimated acceptable loadings from the major municipalities showed that under low streamflow conditions ten sources would impart excessive organic loadings. In addition, some of the proposed wastewater treatment facilities, either industrial or municipal, may still exceed acceptable loadings even though significant reductions over existing organic loadings will be realized. The acceptable loadings were based on the new dissolved oxygen criteria (OWRC, 1970) which upgrade the minimum dissolved oxygen level from 4.0 mg/l to 5.0 mg/l in all streams except in those supporting coldwater fisheries where the minimum dissolved oxygen criteria is 6.0 mg/l. As a result, waste discharges which may have been acceptable in the past now exceed the loading guidelines based on the new, more stringent criteria.

Reduction of nutrient and organic loadings to the system are required for improvement of the water quality in the Grand River Basin and protection of Lake Erie. The comprehensive basin report will consider alternatives, including effluent polishing and streamflow augmentation which can be utilized to increase the potential for use of the river for a variety of purposes while reducing pollution pressures existing in the basin.

DESCRIPTION OF WATER QUALITY PROBLEMS

The installation of sewage treatment facilities in the urban areas of the basin has achieved a major degree of control over pollution caused by discharges of inadequately treated sewage. The treatment plants were constructed before the development of concern for nutrient removal. In the last year, legislative controls restricting limits of the nutrient phosphorus in detergents and cleaning compounds have been imposed in Canada. Further, significant advances in nutrient removal technology at sewage treatment plants now permit increased control over the discharge of nutrients in wastewaters.

Preliminary estimates showed that the loading of phosphorus from sewage treatment plants in the densely populated area of the Grand River Basin accounts for roughly 70 to 80 per cent of the annual input of this nutrient into this basin. During summer low streamflow periods, the per cent contribution is expected to be even greater. Further detail on the nutrient loadings will be presented in the comprehensive basin report.

Nutrients have promoted excessive algae and aquatic plant growths which have become the predominant source of impairment of the water quality in the most densely populated areas of the watershed such as the Speed River downstream from Guelph and in the Grand River downstream from Bridgeport. The worst growths have occurred during summer months when streamflows are generally low and water temperatures high. The Commission previously reported on problems in Canagagique Creek, the Speed River and the Middle Grand River (OWRC, 1966). Recommendations in the report included the need for nutrient removal facilities at treatment plants, and better land use techniques to prevent nutrient enrichment from land run-off.

In addition to reducing the aesthetic quality of the river, the profuse aquatic growths cause extreme variations in the normal daytime-nighttime oxygen content of the water. For the protection of most aquatic life, dissolved oxygen levels should be a minimum of 5.0 mg/l at all times, except in certain cases where concentrations may range between 5 and 4 mg/l for short intervals within any 24-hour period (OWRC, 1970). Under summer streamflow conditions dissolved oxygen variations from 1 mg/l (12% saturation) to 14 mg/l (156% saturation) in the Speed River below Hespeler, and from 2.4 mg/l (29 per cent saturation) to 11.4 mg/l (150 per cent saturation) in the Grand River downstream from Galt were recorded during night and daylight hours respectively.

To assist in analysis of the complex water quality problems, models for the Grand and Speed rivers have been developed, relating the loading pressures created by the organic residuals contained in the sewage treatment plant effluents to the dissolved oxygen content of the river. However, the wide dissolved oxygen fluctuations caused by excessive growths of algae and other aquatic plants have limited the applicability of these models.

In view of the technical difficulties and costs associated with their development, complex mathematical models of the fluctuations in the diurnal-nocturnal levels of dissolved oxygen have not been undertaken. Further, in view of the pending installation of nutrient removal facilities and the possible increase in the streamflow by construction of additional reservoirs or importation of water via pipelines, it was concluded that additional studies should follow these developments in future years.

ESTIMATES OF ACCEPTABLE ORGANIC LOADINGS

(Carbonaceous Oxygen Demand)

For the purpose of this analysis, the watershed was divided into eight sub-basins; namely, Canagagique Creek, Conestogo River, Speed River, Nith River, Fairchild Creek, and Upper, Middle, and Lower Grand River. The boundaries of each sub-basin are shown on Figure 1. The acceptable organic loadings for each sub-basin expressed in terms of five day biochemical oxygen demand (BOD_5) from municipal and industrial waste treatment sources were then determined on the basis of the assumptions and criteria present below.

Basic Assumptions

The loadings were calculated for each tributary basin based on quantitative and qualitative data collected during various studies carried out from 1965 through 1969. The following basic assumptions were made in the analysis:

(a) A nutrient removal program for the entire basin to be implemented by 1975, and

(b) Sufficient reduction in levels of nutrients will be achieved to permit maintenance of the dissolved oxygen values given in Table 1.

Dissolved Oxygen Criteria

To protect existing and potential water uses within the basin, the following dissolved oxygen (DO) criteria were employed:

(a) a minimum 6.0 milligrams per litre (mg/l) level in all streams presently supporting a cold water fishery, in all portions of the river system upstream from existing and proposed flood control reservoirs, and in all streams not presently receiving continuous industrial or municipal waste discharges;

(b) a minimum 5.0 mg/l dissolved oxygen level in all other sections of the basin.

Design Streamflows

The design streamflows used in this report for streams receiving continuous wastewater discharges, are the minimum summer 7-day average low flows equalled or exceeded 95 per cent of the time. For streams receiving seasonal discharges from waste retention ponds, the design streamflows are the minimum monthly flows during the discharge period equalled or exceeded 95 per cent of the time. These were derived from the published data for the flow gauges within the basin. In areas where low flow data were not available the low flows were estimated from nearby representative flow gauges.

Existing Wastewater Loadings

Existing wastewater loadings (Table 1) were obtained from plant records wherever available. Where records were inadequate, these loadings were estimated on the basis of the following assumptions:

(a) Effluent quality BOD_5: - 15 mg/l - activated sludge sewage treatment plant; - 30 mg/l - seasonal discharge lagoons; - 100 mg/l - primary treatment (one plant only).

(b) Wastewater volumes: - contribution rate of 100 gallons per capita per day (gpcd).

(c) Industrial wastewater loadings discharged directly into the basin were estimated from the most recent available data.

RESULTS OF ANALYSIS

The present organic loadings or those expected upon completion of current pollution abatement programs together with acceptable loadings for each major load point are presented in Table 1. Further details on problems occurring within each sub-basin due to organic loadings are contained in Appendix A.

At the present time, there are ten locations where the acceptable organic loading of the stream would be exceeded under low streamflow conditions. Discharges from some of the proposed wastewater treatment facilities, either industrial or municipal may still exceed acceptable loadings even though significant reductions over existing organic loadings will be realized. In some of these cases, the loadings may have been acceptable under the old dissolved oxygen criteria but are now excessive because of the restrictions imposed by the new criteria as well as the additional loading pressures resulting from rapid growth and development of the basin during recent years.

Reduction of the organic loadings to the levels indicated without nutrient control will not permit maintenance of the oxygen balance in the river under present conditions of streamflow. With nutrient control, and providing the specified organic loadings are not exceeded, satisfactory oxygen levels would probably be maintained.

Without streamflow augmentation, it is expected that there will be considerable difficulty in meeting acceptable organic loading limits with conventional secondary waste treatment technology at Kitchener, Guelph, Elmira, Fergus and Elora. It should be possible to produce acceptable effluents with nutrient removal and effluent polishing facilities.

Initially, attention should be directed toward achievement of nutrient reduction from controllable sources and restriction of organic loadings within the acceptable loading guidelines. Realization of these objectives should be regarded as a necessary goal in the next few years for two reasons:

(a) restoration of water quality to a level consistent with the present level of development within the basin. Without rigorous control of waste effluents and land drainage, continued cycles of growth would eventually create pressure on the use of the river that may irretrievably forego recovery of its quality, and

(b) reduction of the nutrient pressures on Lake Erie to comply with the recommendations of the International Joint Commission.

Concurrently, concerted efforts should be devoted to planning and implementing controls over losses of nutrients resulting from poor land use practices. Future planning for subsequent cycles of growth in water use and corresponding increased controls over water quality will necessitate continual review of the loading guidelines in the light of requirements of the subsequent cycles.

It should be noted that the loadings presented are considered to represent the full capacity of the river. At these loading levels, there would not exist any reserve or buffer capacity to absorb fluctuations caused by variations in the quality of sewage treatment plant effluents. If the streamflow is augmented in the future, priority should be given to setting aside reserve capacity recognizing the practical limitation on the maintenance of quality control at sewage treatment plants.

The estimated organic wastewater loadings in Table 1 represent but one of several alternatives for the use of the river for assimilation of treated municipal and industrial wastes. Before the full potential of the basin can be evaluated all the other desirable uses must be considered fully to ensure that conflicting water uses are not created. Furthermore, any changes in the existing flow regime by the construction of additional reservoirs and changes in their operational procedures would have a direct bearing on the water quality alternatives and priorities will, therefore, have to be established for the use of the water in the basin. The comprehensive basin report will compare the various alternatives available and will consider the staging of reservoirs for streamflow augmentation to meet the growth of population and industry consistent with the maintenance of satisfactory water quality.

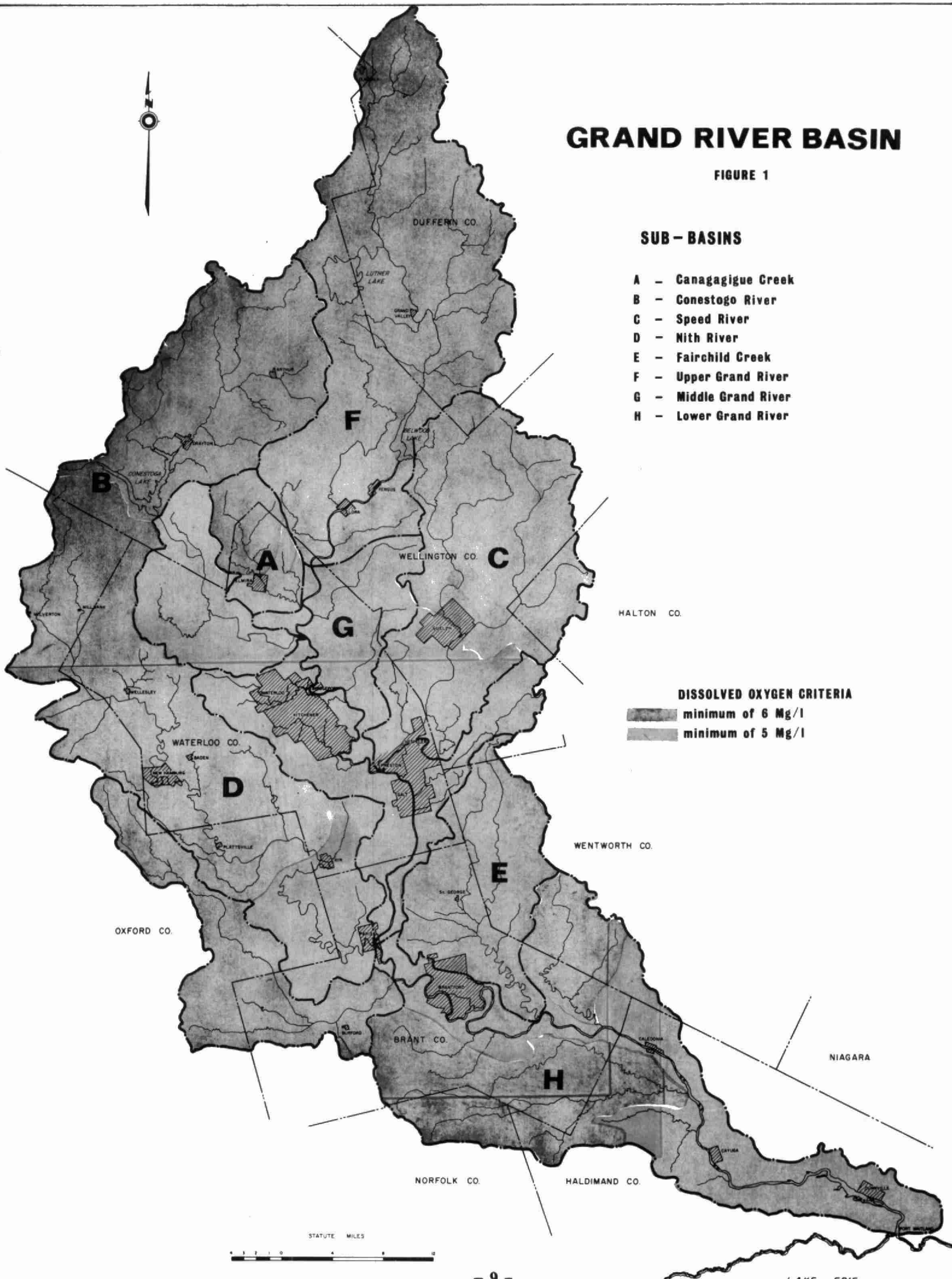
TABLE 1. ORGANIC WASTEWATER LOADING GUIDELINES FOR THE GRAND RIVER BASIN

Municipality	Receiving Stream	Minimum DO Criteria mg/l	Maximum Acceptable BOD_5 Concentration in the Stream mg/l	Total Acceptable Loadings lbs BOD_5/day	Present Industrial and Municipal Loadings lbs BOD_5/day		Comments
Elmira	Canagagigue Ck.	5	4.0	Nil	110 plus *	C	
Arthur	Tributary to the Conestogo R.	6	4.0	200 (during the spring only)	90	S	Stream's loading capacity exceeded during the fall discharge period. Guidelines could be met if lagoons were discharged during spring only.
Drayton	Conestogo R.	6	3.0	300 (during the spring only)	Not defined		Municipal facilities proposed (lagoons); loading guidelines can only be met if discharges are restricted to the spring season.
St. Jacobs	Conestogo R.	5	4.0	40 (continuous discharge)	20 plus 85 to 150	C S	Municipal facilities with continuous discharge proposed; discharges should meet loading guidelines.
Rockwood	Eramosa R.	6	2.5	20 (continuous discharge)	Not defined		Municipal facilities with continuous discharge should meet loading guidelines.
Guelph	Speed R.	5	5.0	700 (continuous discharge)	1500*	C	Expansion of municipal treatment facilities proposed.
Hespeler	Speed R.	5	5.0	500 (continuous discharge)	2000*	C	Municipal and industrial treatment facilities under construction, loadings from these facilities are expected to meet loading guidelines.
Millbank	Nith R.	6	4.0	30 (during the winter months)	50 during winter months only *		
Wellesley	Wellesley	6	4.0	7 (continuous discharge)	Not defined		Municipal treatment facilities proposed; loadings from these are not expected to meet loading guidelines.
New Hamburg	Nith R.	6	4.0	600 (during the spring only)	Not defined due to seepage	S	Loading guidelines could be met if lagoons were discharged during spring only.
Baden	Baden Ck.	6	4.0	Nil	280 plus*	C	Municipal treatment facilities proposed; loadings from these will not meet loading guidelines.
Plattsville	Nith R.	6	2.5	300 (during the spring only)	750 plus*	C	Municipal treatment facilities with semi-annual discharges proposed. Loading guidelines could be met if wastes were discharged only during the spring.
Petersburg	Alder Ck.	5	4.0	Nil	150 to 1000*	S	Improved industrial treatment facilities under construction. Wastewater loadings will not be met.
Ayr	Nith R.	5	3.3	130 (continuous discharge)	20	C	Municipal treatment facilities under review.
St. George	Fairchild Ck.	5	4.0	300 (during the spring only)	400 during winter months only *		Improved industrial treatment facilities under construction. Municipal treatment facilities (lagoons) with semi-annual discharge proposed. Loading guidelines could be met if discharges are restricted to the spring season only.

TABLE 1 (cont'd)

Municipality	Receiving Stream	Minimum DO Criteria mg/l	Maximum Acceptable BOD_5 Concentration in the Stream mg/l	Total Acceptable Loadings lbs BOD_5/day	Present Industrial and Municipal Loadings lbs BOD_5/day	Comments
Dundalk	Foley Drain	6	4.0	20 (during the spring only)	Not defined	Municipal facilities (lagoons) proposed; loading guidelines are not expected to be met.
Grand Valley	Grand R.	6	2.5	5 (continuous discharge)	Not defined	Municipal facilities (continuous discharge) proposed; loading guidelines are not expected to be met.
Fergus and Elora	Grand R.	6	2.5	Combined 70 (continuous discharge)	Fergus - 98* Elora - 12 C	Loading from Elora is expected to increase upon completion of sanitary sewer system.
Waterloo	Grand R.	5	4.0	1500 (continuous discharge)	1000 C	
Kitchener	Grand R.	5	4.0	1100 (continuous discharge)	2100 * C	
Preston	Grand R.	5	4.0	300 (continuous discharge)	180 C	Expansion to municipal treatment facilities proposed.
Galt	Grand R.	5	4.0	1500 (continuous discharge)	900 C	
Paris and Brantford	Grand R.	5	4.0	Combined 2000 (continuous discharge)	Brantford - 1,000 Paris - 100 C	Improved industrial treatment facilities proposed.
Caledonia, Cayuga and Dunnville	Grand R.	5	3.5	Combined 1000 (continuous discharge)	Combined 100 C	

Note:
* Present loadings exceed acceptable loadings
C Denotes continuously discharged loadings
S Refers to loadings discharged semi-annually (during the spring and fall seasons).



GRAND RIVER BASIN

FIGURE 1

APPENDIX A

APPENDIX—A Sub-Basins

A-1 Canagagigue Creek

Canagagigue Creek is a small tributary which joins the Grand River downstream from the site of the proposed West Montrose Dam.

The main waste input into this creek comes from the Town of Elmira (population 4,462) which is located 4 miles upstream from its confluence with the Grand River. The town's municipal and industrial wastes are treated in an activated sludge plant prior to discharge to the Canagagigue Creek. Industrial wastes, including phenols, toxic compounds, and nutrients, create problems in the plant and in the stream that are unique within the entire Grand River Basin.

Since the low flow of Canagagigue Creek at Elmira is estimated to approach zero cfs, the stream is therefore an unsuitable effluent receiver. It has been grossly impaired by the wastes from the sewage treatment plant at Elmira which consistently discharges more than 110 lbs. BOD_5/day. Although efforts have been made to decrease the loading from this plant, water quality impairment will still remain in Canagigigue Creek unless an extremely high degree of treatment is achieved

A-2 Conestogo River Basin

The Conestogo River drains the north-westerly portion of the Grand River Basin and joins the main channel eight miles upstream from the City of Waterloo. The main population centers in this basin are Arthur, Drayton and St. Jacobs.

Village of Arthur

The Village of Arthur (population 1,308) is located on the east branch of the Conestogo River, 10 miles upstream from the Glen Allan Reservoir. The village is served by a waste stabilization pond which discharges into the Conestogo River.

The low flow of the river at Arthur is estimated to be less than 0.1 cfs which precludes continuous wastewater discharges. Likewise low streamflow in the fall precludes any significant wastewater discharges. A seasonal discharge of 200 lbs BOD_5/day is acceptable for a 4-week period from approximately the last week in March to the last week in April. The effluent from the existing lagoon, if discharged during this period only, would probably result in a loading of 180 lbs BOD_5/day.

Village of Drayton

The Village of Drayton (population 697) is located on the Conestogo River at the upstream end of the Glen Allan Reservoir.

The low flow of the Conestogo River at Drayton is approximately 0.1 cfs. Recognizing the proximity to the Glen Allan Reservoir a spring discharge of approximately 300 lbs BOD_5/day would be acceptable during the four week period from the last week in March to the last week in April when the minimum streamflow is 76 cfs.

A provincial sewage project now in the final planning stage will provide a waste stabilization pond to treat the village's domestic and industrial wastes. The loadings from this lagoon, if discharged during the spring only, would be approximately 200 lbs BOD_5/day for the existing population.

Community of St. Jacobs

The Community of St. Jacobs (population 935) is located on the Conestogo River 15 miles downstream from the Glen Allan Reservoir and 4 miles upstream from the confluence of the Conestogo River with the Grand River. The low flow of the Conestogo River at St. Jacobs is 4 cfs. A provincial sewage treatment project for St. Jacobs now in the final design stage will provide an oxidation ditch with continuous discharge for treating the town's domestic and industrial wastes. The wastewater loading from this system will be approximately 20 lbs BOD_5/day for the existing population, well within the estimated acceptable limit of 40 lbs BOD_5/day.

A-3 Speed River Basin

The Speed River basin including the Eramosa River drains the north-easterly portion of the basin and has its confluence with the Grand River at Preston. At the present time, the basin receives municipal and industrial wastes from the City of Guelph, the Town of Hespeler and in the near future from the Police Village of Rockwood.

Police Village of Rockwood

Rockwood (population 920) is located on the Eramosa River upstream from Guelph and downstream from the proposed Everton Reservoir. The Eramosa River at Rockwood has an estimated low flow of 5 cfs which can accept a wastewater loading of 20 lbs BOD_5/day at a point downstream from the existing conservation authority dam. An oxidation ditch with a continuous discharge has been proposed to serve the community of Rockwood. The loading from this sytem is expected to approximate the allowable loading of 20 lbs BOD_5/day.

City of Guelph

Guelph (population 55,625) is located at the confluence of the Eramosa and Speed Rivers. The city's 6 mgd treatment plant is currently being expanded to 10 mgd, with all wastes from industries in Guelph, the university and the reformatory being directed to the plant. The high reaeration capacity of the stream below Guelph will permit the discharge of approximately 700 lbs BOD_5/day from Guelph. The existing loading from the Guelph sewage treatment plant is about 1,500 lbs BOD_5/day.

Town of Hespeler

The low flow in the river at Hespeler, 10 miles downstream from Guelph, is estimated at 36 cfs. Restriction of the loading to approximately 500 lbs BOD_5/day at Hespeler will protect the quality of the water. At present, waste treatment facilities for the treatment of both municipal and industrial wastes from the Town of Hespeler are under construction. Once completed, the total loading from Hespeler is expected to be reduced from about 2,000 lbs BOD_5/day to 300 lbs BOD_5/day.

A-4 Nith River Basin

The Nith River Basin rises in the southern portion of Maryborough Township, Wellington County, and flows south-easterly to its confluence with the Grand River at the Town of Paris. The following communities in this basin have significant wastewater discharges: Millbank, Wellesley, Baden, New Hamburg, Plattsville, and Ayr.

The construction of the Ayr Reservoir proposed by the Grand River Conservation Authority may require severe reductions in the wastewater loadings from the upstream communities in an effort to protect the water quality of the reservoir. Since the Ayr Reservoir may be built in the near future, it would be advisable to restrict both the organic wastewater and nutrient loadings at this time by controlling further development of the upstream areas.

Community of Millbank

Millbank is located in the headwaters of the Nith River. The community is presently serviced by individual septic tanks. A local industry discharges about 50 lbs BOD_5/day during the winter months. This loading exceeds the acceptable loading of 30 lbs BOD_5/day during this discharge period.

Village of Wellesley

Wellesley (population 810) is located on Wellesley Creek about 1 mile upstream from its confluence with the Nith River. Municipal sewage treatment facilities have been proposed for the village. The wastewater discharges from this facility would exceed the stream's estimated assimilative capacity of 7lbs BOD_5/day which is based on a low flow of less than 1 cfs.

Community of Petersburg

Petersburg is located in the headwaters of Alder Creek. Natural streamflows in this creek are generally near zero cfs and is therefore an unsuitable wastewater receiver. The community is presently serviced by individual septic tanks. A local industry discharges high strength wastewaters to the creek on a seasonal basis (from 150 to 1000 lbs BOD_5/day). Although the industrial loading will be significantly reduced upon completion of improved treatment facilities presently under construction, some impairment of the stream is still expected.

Town of New Hamburg

The Town of New Hamburg (population 2,816) is located on the Nith River 20 miles upstream from the proposed Ayr Reservoir.

The Nith River in this area has a low flow of 2.7 cfs and could accept a continuous loading of 10 lbs BOD_5/day. With a discharge from mid-March to mid-April only, when the minimum monthly flow is estimated at 120 cfs, the Nith River could receive a loading of 600 lbs BOD_5/day.

At present, the Town of New Hamburg is served by a 14 acre waste stabilization lagoon. For the past two years effluent discharge has not been necessary due to a high rate of seepage from the lagoon. If the lagoon were discharged during spring only, the loading would be approximately 500 lbs BOD_5/day.

Police Village of Baden

Baden (population 973) is located about four miles east of New Hamburg on Baden Creek. A local industry is presently discharging a loading of 280 lbs BOD_5/day to Baden Creek which together with discharges from poorly-functioning septic tank systems throughout the village results in serious water quality impairment in the creek. The natural low flows of Baden Creek approach zero cfs which preclude continuous wastewater discharges if acceptable water quality conditions are to be achieved. A sewage treatment system utilizing an oxidation ditch has been proposed to treat the communities wastewaters. This system will reduce pollution problems in Baden Creek significantly even though it will fall short of solving the problem entirely.

Police Village of Plattsville

Plattsville (population 560) is located on the Nith River approximately 5 miles upstream from the site of the proposed Ayr dam and one mile above the upstream limits of the future reservoir. The village is presently serviced by poorly functioning privately owned septic tank systems which bypass periodically to the Nith River. A local industry also discharges about 750 lbs BOD_5/day to the Nith River which results, at times, in water quality impairment in the receiver.

A waste stabilization pond has been proposed for treatment of the municipal and industrial wastewaters from the village. Because of the proximity of Plattsville to the proposed Ayr Reservoir discharges from a communal sewage treatment system should be limited to the periods of high spring flows only. Minimum monthly streamflows of the Nith River during the spring are estimated at 150 cfs. This streamflow could assimilate a loading of about 300 lbs BOD_5/day without significant water quality impairment in the future impoundment. Discharges during spring only from the proposed waste stabilization pond for Plattsville would result in a loading of about 200 lbs BOD_5/day over a 30 day period which would be well within the acceptable loading limitation.

Village of Ayr

Ayr (population 1,224) is located on the Nith River 5 miles downstream from the site of the proposed Ayr dam.

A sewage treatment system to treat the municipal wastes from the town is under review. A local industry has its own secondary treatment works already in operation and discharges a loading of about 20 lbs BOD_5/day to the Nith River. The low flow of the Nith River at Ayr is about 35 cfs which can accept a loading of 130 lbs BOD_5/day.

A-5 Fairchild Creek

The Fairchild Creek basin joins the Grand River at Onondago downstream from Brantford. The Police Village of St. George (population 963), the largest municipality in the basin, is located about 15 miles upstream from the confluence of Fairchild Creek with the Grand River. There is insufficient streamflow at St. George to receive continuous or semi-annual wastewater discharges. Minimum monthly spring flow at St. George is estimated at 26 cfs based on four years of records. The acceptable loading during this period is about 300 lbs BOD_5/day.

A local industry is discharging a loading of about 400 lbs BOD_5/day during the winter months. Improved treatment facilities for this industry are under construction.

A waste stabilization pond to be discharged twice a year has been proposed for treatment of domestic waste from the community. Discharges from this system during the fall could result in significant water quality impairment in Fairchild Creek. If this lagoon were emptied during the spring only, a loading of about 280 lbs BOD_5/day would be exerted on the receiver. This approximates the allowable loading providing that the industrial wastewater loadings, if any, does not exceed 20 lbs BOD_5/day during the spring discharge period.

A-6 Upper Grand River

The Upper Grand River extends from the headwaters of the main channel of the Grand River basin to the site of the proposed West Montrose Dam. Dundalk, Grand Valley, Fergus and Elora are the principal population centres of the basin.

Village of Dundalk

Dundalk (population 937) is located in the headwaters of the Grand River Basin some 30 miles upstream from Belwood Lake. A waste stabilization pond with seasonal discharge to Foley Drain has been proposed to treat domestic and industrial wastes from the village. Low streamflows in Foley Drain generally preclude continuous or semi-annual wastewater discharges. Minimum monthly streamflow during spring runoff period is only 2 cfs which restricts the acceptable loading to about 20 lbs BOD_5/day. If the proposed lagoon were discharged only during the spring run-off, the loading would be about 300 lbs BOD_5/day.

Village of Grand Valley

Grand Valley (population 872) is located on the Upper Grand River approximately 10 miles upstream from Belwood Lake. An oxidation ditch with continuous discharge has been proposed to treat both domestic and industrial wastes from the village. It is estimated that the wastewater loading from this system would be 18 lbs BOD_5/day. The minimum streamflows in the Grand River at Grand Valley is estimated to be 1 cfs. This streamflow has a maximum acceptable loading capacity of only 5 lbs BOD_5/day.

Town of Fergus and Village of Elora

Fergus (population 5,191) and Elora (population 1,766) are located downstream from the Shand Dam three and six miles, respectively. Due to the close proximity of the two municipalities, the effects of the two waste discharges on the water quality of the river had to be considered together.

The low flow in the Grand River in the Fergus-Elora area is estimated at 19 cfs. The present loading from these communities is approximately 110 lbs BOD_5/day (Fergus 98 lbs BOD_5/day, Elora 12 lbs BOD_5/day), and exceeds the estimated acceptable loading level of 70 lbs BOD_5/day.

A-7 Middle Grand

The Middle Grand River extends from the site of the proposed West Montrose Dam to the Town of Paris. This is the most densely populated and industrialized area of the Grand River Basin. The major urban centres include Waterloo, Kitchener, Preston and Galt plus several smaller communities.

The low flows in Grand River in this reach are largely governed by the operation of the three flood control reservoirs upstream from Waterloo. The estimated low flow is 124 cfs immediately upstream from the Kitchener sewage treatment plant and 220 cfs at Galt.

With the exception of a two mile stretch extending upstream from the dam at Galt, the Grand River in this reach has a high capacity for assimilating organic materials.

The loading alternative presented in this report makes maximum use of the waste assimilative capacity of the River in the Kitchener-Waterloo area. It is recognized that other alternatives are possible and these will be presented in the comprehensive report.

City of Waterloo

Waterloo (population 33,258) is located approximately 16 miles downstream from the site of the proposed West Montrose Reservoir. The industrial and municipal wastewaters receive secondary degree treatment prior to discharge to the Grand River. The present loading from the system is approximately 1000 lbs BOD_5/day which is within the acceptable loading of 1500 lbs BOD_5/day if Waterloo is allotted the total capacity of the river at this location.

City of Kitchener

Kitchener (population 105,245) is located immediately downstream from Waterloo. The industrial and municipal wastewaters receive secondary degree treatment prior to discharge into the Grand River. The present loading from the plant is about 2100 lbs BOD_5/day which exceeds the acceptable loading of 1100 lbs BOD_5/day. If the loading allotted to Waterloo were reduced, the acceptable loading from Kitchener could be increased somewhat. As mentioned earlier, various loading alternatives will be presented in the comprehensive report.

Town of Preston

Preston (population 15,089) is located at the confluence of Speed and Grand rivers. The municipal and industrial wastewaters receive secondary degree treatment prior to discharge into the Grand River. The present loading is estimated to be 180 lbs BOD_5/day. Due to the proximity of the upstream wastewater discharges, the acceptable loading at Preston is limited to 300 lbs BOD_5/day.

City of Galt

Galt (population 36,330) is located approximately 4 miles downstream from the confluence of the Speed and Grand rivers. The municipal and industrial wastewaters are treated in an activated sludge plant which at present discharges a loading of 900 lbs BOD_5/day into the Grand River. The Grand River downstream from Galt has excellent wastewater assimilation characteristics and could accept an estimated loading of 1500 lbs BOD_5/day.

A-8 Lower Grand River

The Lower Grand River extends from the Town of Paris to Lake Erie. The low flow in this section is largely governed by the operation of the upstream flood control reservoirs. This reach has been arbitrarily sub-divided into two distinct sections: the first extending from the Town of Paris to the Town of Caledonia, with the second from Caledonia to the mouth of the Grand River at Port Maitland.

The major urban centres in the first section are Paris and Brantford. The waste assimilation capacity of this reach is generally high. Adequate water quality could be maintained in this reach by restricting loads to 2,000 lbs BOD_5/day under low flow condition which is estimated to be 340 cfs. The present combined loading from Brantford and Paris are estimated at 1,100 lbs BOD_5/day (Brantford 1000 lbs BOD_5/day, Paris 100 lbs BOD_5/day).

The urban centres with municipal wastewater treatment facilities in the second section are Caledonia, Cayuga, and Dunnville. The relative waste assimilative capacity of this reach is significantly lower than in the upper section. The low flow at Cayuga is estimated to be 360 cfs. This flow can accept a total loading of approximately 1,000 lbs BOD_5/day. When all municipal sewage treatment proposals presently under development are completed, the loadings on the lower reach of the lower Grand River will be approximately 100 lbs BOD_5/day.